Mathematical Modeling for Flapping Wings

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Abstract— This paper presents a mathematical model of flapping wings mechanism. MAV (Micro-aerial vehicle) kinematics model is studied by using a drive engine and two movable levers. The study of the two movable leavers is based on the mechanisms' theory; by means of the existing experimental models, we make an analysis in amplitude. The mathematical model has been software implemented in Matlab/Simulink environment and validated by complex numerical simulations. In the specialty literature, beside the model discussed above, there are other two flapping wing mechanisms. One of the models is characterized by only one lever driven by the engine axis. Another model has one engine, 2 movable levers, and a torsion spring. The numerical simulation results validate the mathematical model and the results obtained by other researchers in their works. The experience gained from the development of this mechanism may be used to incorporate the designed system into a future system and, therefore, it may be another step on the way to an autonomous micro-aerial vehicle with flapping wings. The paper is organized as follows: three architectures of flapping wing mechanisms are given in section II; these architectures are software implemented in section III and some characteristics are obtained for the most important one of them. Finally, some conclusions are shared in section IV.